IN THE SPECIFICATION

Please replace the paragraph at page 4, line 12 to page 5, line 1, with the following rewritten paragraph:

The image projection methods of Prior Art 1 and 3 perform image formation using only one or more reflecting mirrors to magnify and project a single ~~lightbulb~~ light valve image on a screen. Therefore, these image projection methods enjoy the merit of no generation of chromatic aberration in principle. In the case of displaying images of red, green, and blue separately, using three ~~lightbulbs~~ light valves instead of a single ~~lightbulb~~ light valve, and combining the separate images on a screen, the intervention of a color combining part such as a cross prism or a Philips prism is necessary, thus resulting in the generation of chromatic aberration at the time of combining colors. However, the imaging optical system composed of only reflecting surfaces cannot correct chromatic aberration.

Please replace the paragraph at page 8, line 11 to page 9, line 3, with the following rewritten paragraph:

One or more of the above-described objects of the present invention are achieved by a projection optical system for use in an image projection apparatus illuminating a ~~lightbulb~~ light valve forming an image in accordance with a modulating signal with illumination light from a light source, the projection optical system including first and second optical systems arranged along an optical path defining an upstream-downstream direction in an order described from upstream to downstream on a downstream side of the ~~lightbulb~~ light valve, wherein the first optical system includes at least one dioptric system and has positive power; the second optical system includes at least one reflecting surface having power and has positive power; and the image formed by the ~~lightbulb~~ light valve is formed as an

intermediate image in the optical path, and the intermediate image is magnified and projected.

Please replace the paragraph at page 9, lines 4-18, with the following rewritten paragraph:

The above-described projection optical system includes a first optical system and a second optical system. The image formed by the ~~lightbulb~~ light valve is formed as an intermediate image in the optical path of the first and second optical systems, and the intermediate image is further magnified and projected. Accordingly, high projection magnification can be realized. Since the first optical system includes a dioptric system, chromatic aberration is correctable using the chromatic dispersion characteristic even in the case of employing a color composite prism. Further, since the optical path of imaging light beams is folded back by a reflecting surface of the second optical system, the projection optical system can be made compact.

Please replace the paragraph at page 9, line 19 to page 10, line 12, with the following rewritten paragraph:

One or more of the above objects of the present invention are also achieved by an image projection apparatus that illuminates a ~~lightbulb~~ light valve forming an image in accordance with a modulating signal with illumination light from a light source, the image projection apparatus including: a projection optical system, the projection optical system including first and second optical systems arranged along an optical path defining an upstream-downstream direction in an order described from upstream to downstream on a downstream side of the ~~lightbulb~~ light valve, wherein the first optical system includes at least one dioptric system and has positive power; the second optical system includes at least one

reflecting surface having power and has positive power; and the image formed by the ~~lightbulb~~ light valve is formed as an intermediate image in the optical path, and the intermediate image is magnified and projected by the projection optical system.

Please replace the paragraph at page 15, lines 7-24, with the following rewritten paragraph:

One or more of the above objects of the present invention are also achieved by a projection optical system, including: a first optical system including at least one dioptric system and having positive power; and a second optical system including one or more reflecting surfaces having power, the second optical system having positive power as a whole, wherein the first and second optical systems are arranged along an optical path defining an upstream-downstream direction in an order described from upstream to downstream on a downstream side of an object surface; an object image is temporarily formed as an intermediate image, and thereafter, is formed as a ~~normal~~ final image; and with respect to an optical axis of an optical element positioned at a furthest upstream end of the first optical system and having refractive power, at least one of other optical elements is shifted or tilted.

Please replace the paragraph at page 15, line 25 to page 16, line 19, with the following rewritten paragraph:

One or more of the above objects of the present invention are also achieved by a projection optical system, including: a first optical system including at least one dioptric system and having positive power; and a second optical system including one or more reflecting surfaces having power, the second optical system having positive power as a whole, wherein the first and second optical systems are arranged along an optical path

defining an upstream-downstream direction in an order described from upstream to downstream on a downstream side of an object surface; an object image is temporarily formed as an intermediate image, and thereafter, is formed as a ~~normal~~ final image; and in the first optical system, with respect to an optical axis of one of optical elements of the first optical system, which one is positioned at a furthest upstream end of the first optical system and has refractive power, the other optical elements are prevented from being tilted.

Please replace the paragraph at page 17, line 10 to page 18, line 7, with the following rewritten paragraph:

One or more of the above objects of the present invention are also achieved by an image projection apparatus that, by a projection optical system, guides a light beam from an image display panel to a screen and forms on the screen a ~~normal~~ final version of the image displayed on the image display panel, wherein: the projection optical system includes: a first optical system including at least one dioptric system and having positive power; and a second optical system including one or more reflecting surfaces having power, the second optical system having positive power as a whole; the first and second optical systems are arranged along an optical path defining an upstream-downstream direction in an order described from upstream to downstream on a downstream side of an object surface; an object image is temporarily formed as an intermediate image, and thereafter, is formed as a ~~normal~~ final image; and with respect to an optical axis of an optical element positioned at a furthest upstream end of the first optical system and having refractive power, at least one of other optical elements is shifted or tilted.

Please replace the paragraph at page 18, line 8 to page 19, line 6, with the following rewritten paragraph:

One or more of the above objects of the present invention are also achieved by an image projection apparatus that, by a projection optical system, guides a light beam from an image display panel to a screen and forms on the screen a ~~normal~~ final version of the image displayed on the image display panel, wherein: the projection optical system includes: a first optical system including at least one dioptric system and having positive power; and a second optical system including one or more reflecting surfaces having power, the second optical system having positive power as a whole; the first and second optical systems are arranged along an optical path defining an upstream-downstream direction in an order described from upstream to downstream on a downstream end of an object surface; an object image is temporarily formed as an intermediate image, and thereafter, is formed as a ~~normal~~ final image; and in the first optical system, with respect to an optical axis of one of optical elements of the first optical system, which one is positioned at a furthest upstream end of the first optical system and has refractive power, the other optical elements are prevented from being tilted.

Please replace the paragraph at page 19, line 10 to page 20, line 12, with the following rewritten paragraph:

One or more of the above objects of the present invention are also achieved by a projection optical system guiding and projecting a light beam from a projected object surface onto a projection surface in an upstream-downstream direction through a transmission dioptric system and a reflection dioptric system of one or two reflecting mirrors, wherein: the transmission dioptric system includes a plurality of transmission refractive elements; substantial telecentricity is provided from the projected object surface up to a first surface of

the transmission dioptric system; an intermediate image surface of the projected object surface is positioned closer to the reflection dioptric system than to the transmission dioptric system, and an intermediate image on the intermediate image surface is formed as a ~~normal~~ final image on the projection surface via the reflecting mirrors; the reflecting mirrors include at least one anamorphic polynomial free-form surface having different vertical and lateral powers; a light beam from the reflection dioptric system to the projection surface is guided at an angle to a normal of the projection surface; and the transmission dioptric system is decentered with respect to a normal of the projected object surface, and the transmission refractive elements of the transmission dioptric system are prevented from being decentered with respect to each other.

Please replace the paragraph at page 20, line 13 to page 21, line 15, with the following rewritten paragraph:

One or more of the above objects of the present invention are also achieved by a projection optical system guiding and projecting a light beam from a projected object surface onto a projection surface in an upstream-downstream direction through a transmission dioptric system and a reflection dioptric system of one or two reflecting mirrors, wherein: the transmission dioptric system includes a plurality of transmission refractive elements; substantial telecentricity is provided from the projected object surface up to a first surface of the transmission dioptric system; an intermediate image surface of the projected object surface is positioned closer to the reflection dioptric system than to the transmission dioptric system, and an intermediate image on the intermediate image surface is formed as a ~~normal~~ final image on the projection surface via the reflecting mirrors; the reflecting mirrors include at least one anamorphic polynomial free-form surface having different vertical and lateral powers; a light beam from the reflection dioptric system to the projection surface is guided at

an angle to a normal of the projection surface; and the transmission dioptric system is decentered with respect to a normal of the projected object surface, and the transmission refractive elements of the transmission dioptric system are prevented from being decentered with respect to each other at a group unit level.

Please replace the paragraph at page 21, line 18 to page 22, line 24, with the following rewritten paragraph:

One or more of the above objects of the present invention are also achieved by an image projection apparatus magnifying an image displayed on a projected object surface and projecting the magnified image on a projection surface by a projection optical system, wherein: the projection optical system guides and projects a light beam from the projected object surface onto the projection surface in an upstream-downstream direction through a transmission dioptric system and a reflection dioptric system of one or two reflecting mirrors; the transmission dioptric system includes a plurality of transmission refractive elements; substantial telecentricity is provided from the projected object surface up to a first surface of the transmission dioptric system; an intermediate image surface of the projected object surface is positioned closer to the reflection dioptric system than to the transmission dioptric system, and an intermediate image on the intermediate image surface is formed as a ~~normal~~ <u>final</u> image on the projection surface via the reflecting mirrors; the reflecting mirrors include at least one anamorphic polynomial free-form surface having different vertical and lateral powers; a light beam from the reflection dioptric system to the projection surface is guided at an angle to a normal of the projection surface; and the transmission dioptric system is decentered with respect to a normal of the projected object surface, and the transmission refractive elements of the transmission dioptric system are prevented from being decentered with respect to each other.

Please replace the paragraph at page 23, line 16 to page 24, line 7, with the following rewritten paragraph:

an intermediate image surface of the projected object surface is positioned closer to the reflection dioptric system than to the transmission dioptric system, and an intermediate image on the intermediate image surface is formed as a ~~normal~~ final image on the projection surface via the reflecting mirrors; the reflecting mirrors include at least one anamorphic polynomial free-form surface having different vertical and lateral powers; a light beam from the reflection dioptric system to the projection surface is guided at an angle to a normal of the projection surface; and the transmission dioptric system is decentered with respect to a normal of the projected object surface, and the transmission refractive elements of the transmission dioptric system are prevented from being decentered with respect to each other at a group unit level.

Please replace the paragraph at page 27, lines 2-13, with the following rewritten paragraph:

Referring to FIG. 1, the image projection apparatus includes a ~~lightbulb~~ light valve 15, which is a liquid crystal panel in this embodiment. The ~~lightbulb~~ light valve 15 is hereinafter referred to simply as a panel 15. The image projection apparatus further includes a light source 10 composed of a light emitting part 11 and an illumination optical system 12. The light emitting part 11 is composed of a lamp and a reflector. A light beam from the light emitting part 11 is illumination light in the illumination optical system 12. The illumination light from the light source 10 illuminates the panel 15.

Please replace the paragraph at page 37, lines 8-17, with the following rewritten paragraph:

The above-described matter may be implemented by providing, on the ~~lightbulb~~ light valve side of the intermediate image (the side upstream of the intermediate image in the upstream-downstream direction from the panel 15 to the screen 21) in the optical path of the first and second optical systems, an optical element having negative power for bringing the position at which the intermediate image is formed close to the reflecting surface having positive power of the second optical system.

Please replace the paragraph at page 39, lines 11-18, with the following rewritten paragraph:

The projection optical system slightly increases in size to move the position of the intermediate image I_{int} away from the ~~lightbulb~~ light valve 15. However, by forming the above-described negative-power optical element of a reflecting mirror, it is possible to employ a layout folding back an optical path, thereby reducing the size of the entire optical system.

Please replace the paragraph at page 45, lines 2-7, with the following rewritten paragraph:

In the case of replacing the transmission liquid crystal panel employed as the ~~lightbulb~~ panel 15 with a reflection liquid crystal ~~lightbulb~~ light valve, efficient illumination can be performed by splitting an illumination optical path and a projection optical path using a polarization beam splitter.

Please replace the paragraph at page 45, lines 8-13, with the following rewritten paragraph:

Further, in the case of employing a Digital Micromirror Device (DMD) as a ~~lightbulb~~ light valve, an optical path splitting optical system using an oblique incidence optical system or a total reflection prism may be employed. Thus, a suitable optical system may be employed in accordance with a ~~lightbulb~~ light valve type.

Please replace the paragraph at page 45, lines 14-22, with the following rewritten paragraph:

In a front-type projector, it is desirable that a projected image be shifted upward so as not to be hidden behind the projector when viewed from a viewer. That is, the ~~lightbulb~~ light valve 15 is shifted (downward in FIG. 1) in a plane perpendicular to the optical axis of the projection optical system (the optical axis of the first optical system 17) so that light beams are made incident on the projection optical system from its lower side.

Please replace the paragraph at page 45, line 23 to page 46, line 6, with the following rewritten paragraph:

As the shift of the ~~lightbulb~~ light valve 15 increases, particularly, an effective angle of view should be widened as a specification required for the first optical system 17. The shift of the ~~lightbulb~~ light valve 15 is set to a suitable size. The intermediate image I_{int} is formed temporarily by the first optical system 17. The image formed by the ~~lightbulb~~ light valve 15 is magnified and projected onto the screen 21 by the positive-power second optical system 19.

Please replace the paragraph at page 46, line 20 to page 47, line 11, with the following rewritten paragraph:

The projection optical system according to this embodiment includes the first optical system 17 and the second optical system (for instance, the second optical system 19). The image formed by the ~~lightbulb~~ light valve 15 is formed as an intermediate image in the optical path of the first and second optical systems 17 and 19, and the intermediate image is further magnified and projected. Accordingly, high projection magnification can be realized. Since the first optical system 17 includes a dioptric system, chromatic aberration is correctable using the chromatic dispersion characteristic even in the case of employing a color composite prism. Further, since the optical path of imaging light beams is folded back by a reflecting surface of the second optical system 19, the projection optical system can be made compact.

Please replace the paragraph at page 47, line 21 to page 48, line 3, with the following rewritten paragraph:

Referring to FIG. 6, the reference ray of a group of light beams traveling from an image display panel 1 (hereinafter referred to simply as a panel 1) toward a screen 2 is made incident thereon at a predetermined angle to the normal (perpendicular) of the screen 2. The reference ray is the principal ray of a light beam guided from the center of the panel 1 to the screen 2.

Please replace the paragraph at page 67, lines 13-25, with the following rewritten paragraph:

As the object displaying an image to be projected, one configured to illuminate the ~~lightbulb~~ light valve 15 with a light beam from the light emitting part 11 formed of the lamp

and the reflector through the illumination optical system 12, as described with reference to FIG. 1, may be employed. Specifically, a halogen lamp, a xenon lamp, a metal halide lamp, or a super-high pressure mercury lamp is suitable as the light emitting part 11. An integrator optical system that makes the intensity of the light beam reflected from the reflector to have directivity uniform with respect to the ~~lightbulb~~ light valve 15 may be employed as the illumination optical system 12.

Please replace the paragraph at page 68, lines 1-12, with the following rewritten paragraph:

As the above-described object, a type of object that performs optical path splitting with respect to a DMD panel using an oblique incidence optical system or a total reflection prism may be employed. A type of image display device illuminated with light from an external light source, such as a ~~lightbulb~~ light valve such as a liquid crystal panel, a DMD, or a film slide, may also be employed as the above-described object. An object of a self-luminous type, such as a two-dimensional arrangement of light-emitting diodes, an LED array, an EL array, or a plasma display, may also be employed.

Please replace the paragraph at page 68, line 13 to page 69, line 8, with the following rewritten paragraph:

The projection optical system shown in FIGS. 7 and 8 includes the positive-power first optical system 71 including at least one dioptric system (such as the lens 711) and the second optical system 72 having positive power as a whole and including at least one reflecting surface having power (such as the reflecting surface 721). The first and second optical systems 71 and 72 are provided in the order described from the object surface side so that an object image is formed temporarily as an intermediate image, and thereafter, is formed

as a ~~normal~~ final image. In the first optical system 71, with respect to the optical axis of the lens (optical element) 711, positioned furthest on the object side (closest to the object) and having refractive power, the other optical elements, or the lenses 712 through 716 and the reflecting surfaces 721 and 722, are shifted or tilted. That is, a shift or tilt is caused in units of optical elements. The dioptric system may include a light transmitting type element performing diffraction.

Please replace the paragraph at page 70, line 9 to page 71, line 15, with the following rewritten paragraph:

Referring to FIG. 10, reference numeral 100 denotes an object-side part of a type that illuminates a reflection liquid crystal panel with linearly polarized illumination light via a polarization beam splitter so that reflected light beams modulated by the liquid crystal panel become imaging light beams through the polarization beam splitter as described above with reference to FIG. 6. The image display surface of the reflection liquid crystal panel is a projected object surface (a surface on which an image to be projected is displayed as an object). In FIG. 10, PB denotes the polarization beam splitter. The object-side configuration is not limited to this. The configuration described above with reference to FIG. 1 where the ~~lightbulb~~ light valve 15 is illuminated with a light beam from the light emitting part 11 formed of the lamp and the reflector through the illumination optical system 12 may also be employed. This configuration may include an integrator optical system. Further, a configuration that performs optical path splitting with respect to a DMD panel using an oblique incidence optical system or a total reflection prism may be employed. The projected object surface may be realized by a type of image display device illuminated with light from an external light source, such as a ~~lightbulb~~ light valve such as a liquid crystal panel, a DMD, or a film slide. Alternatively, an object of a self-luminous type, such as a two-dimensional

array of light emitting diodes, an LED array, an EL array, or a plasma display, may also be employed.

Please replace the paragraph at page 72, line 17 to page 73, line 10, with the following rewritten paragraph:

The transmission dioptric system 120 includes the lenses (transmission refractive elements) 121 through 127. It is substantially telecentric from the projected object surface up to the first surface (the object-side surface of the lens 121) of the transmission dioptric system 120 as shown in FIG. 10. The intermediate image surface of the projected object surface is positioned between the reflecting mirrors 131 and 132 of the reflection dioptric system 130. An intermediate image on the intermediate image surface is re-formed as a ~~normal~~ final image on the projection surface via the second reflecting mirror 132. The transmission refractive element means a general optical element performing refraction of light at the interface of a light transmitting medium, and is typically a lens. Alternatively, the transmission refractive element may be a light transmitting element performing diffraction.

Please replace the paragraph at page 75, line 13 to page 76, line 5, with the following rewritten paragraph:

Embodiment 1 is a specific embodiment of the image projection apparatus and the projection optical system of FIGS. 7 and 8. That is, Embodiment 1 includes the first optical system 71 having positive power and including at least one dioptric system and the second optical system 72 including at least one reflecting surface having power and having positive power as a whole. The first and second optical systems 71 and 72 are arranged in the order described from upstream to downstream on the downstream side of the object surface. An object image is temporarily formed as an intermediate image, and thereafter, is formed as a

~~normal~~ final image. The optical elements 712 through 716, 721, and 722 are shifted or tilted with respect to the optical axis of the optical element 711 having refractive power, which is positioned at the furthest upstream end of the first optical system 71.

Please replace the paragraph at page 78, last line to page 79, line 10, with the following rewritten paragraph:

The image surface (screen) of the ~~normal~~ final image is a plane surface parallel to the rightward and leftward directions of FIG. 7. There is a great difference in angle of incidence to the screen between a lower position (closer to the object) and a higher position (remoter from the object) of the image height. Therefore, the projected image tends to be narrowed downward and distorted. In this embodiment, distortion on the final image surface is corrected by inversely setting the distortion of the intermediate image.

Please replace the paragraph at page 89, line 3 to page 90, line 9, with the following rewritten paragraph:

As described above, each of Embodiments 1 through 5 includes a positive-power first optical system including at least one dioptric system and a second optical system having positive power as a whole, the second optical system including at least one reflecting surface having power. The first and second optical systems are arranged in the order described from upstream to downstream on the downstream side of an object. An object image is temporarily formed as an intermediate image, and thereafter, is formed as a ~~normal~~ final image. With respect to the optical axis of an optical element that is positioned furthest on the object side in the first optical system and has refractive power, one or more of the other optical elements are shifted or tilted. In Embodiments 3 through 5, with respect to the optical axis of the optical element (lens) 911, positioned furthest on the object side in the first optical

system and having refractive power, the other optical elements 912 through 915 of the first optical system 91 are not tilted.

Please replace the paragraph at page 90, line 14 to page 91, line 1, with the following rewritten paragraph:

In each of Embodiments 1 through 5, at least one of the reflecting surfaces included in the second optical system is a free-form surface. Of the reflecting surfaces included in the second optical system, the reflecting surface positioned furthest on the side of the position at which the ~~normal~~ final image is formed is a free-form surface. Further, in Embodiments 1 through 5, the reflecting surface having positive power and reflecting a light beam made incident on the second optical system first is rotationally symmetric. In Embodiments 1 and 3 through 5, the rotationally symmetric reflecting surface is a spherical reflecting surface.

Please replace the paragraph at page 97, line 24 to page 98, line 20, with the following rewritten paragraph:

In the case of forming the transmission dioptric system, its NA on the projected object surface side (hereinafter, an NA1) is determined by the orientation distribution characteristics of an illumination system, while its NA on the intermediate image surface side (hereinafter, an NA2) is changeable by the arrangement and the configuration of the transmission dioptric system. In order to increase magnification of projection, it is effective to increase the power of the reflection dioptric system. This, however, reduces the focal length of the reflection dioptric system on its image or downstream side so that the focal point of light beams is shifted to the reflecting mirror side of the reflection dioptric system. As a result, only a small-size ~~normal~~ final image can be formed. That is, magnification is reduced. In order to eliminate this disadvantage, the NA2 of light beams incident on the reflection dioptric system

was focused on. As a result, it was determined that making the NA2 smaller than the NA1 had a remarkable effect in increasing the projection optical system magnification.

Please cancel the original Abstract at page 138, lines 1-17 in its entirety and insert therefor the following replacement Abstract on a separate sheet as follows: